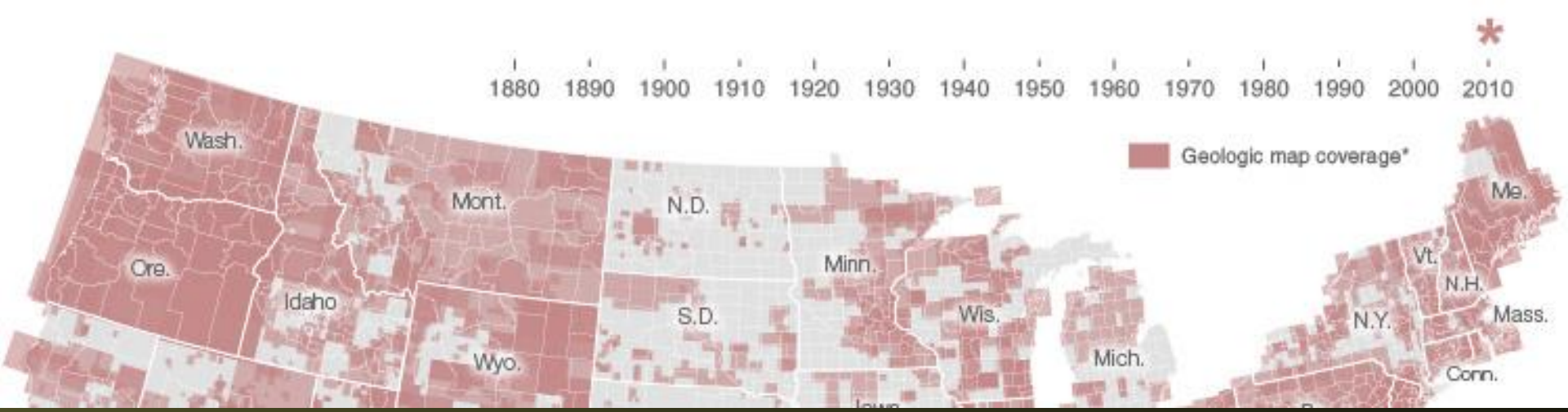


# Potential methods for comprehensive assessment of the status of geologic mapping in the U.S.

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MINNESOTA GEOLOGICAL SURVEY

COLLEGE OF Science & Engineering

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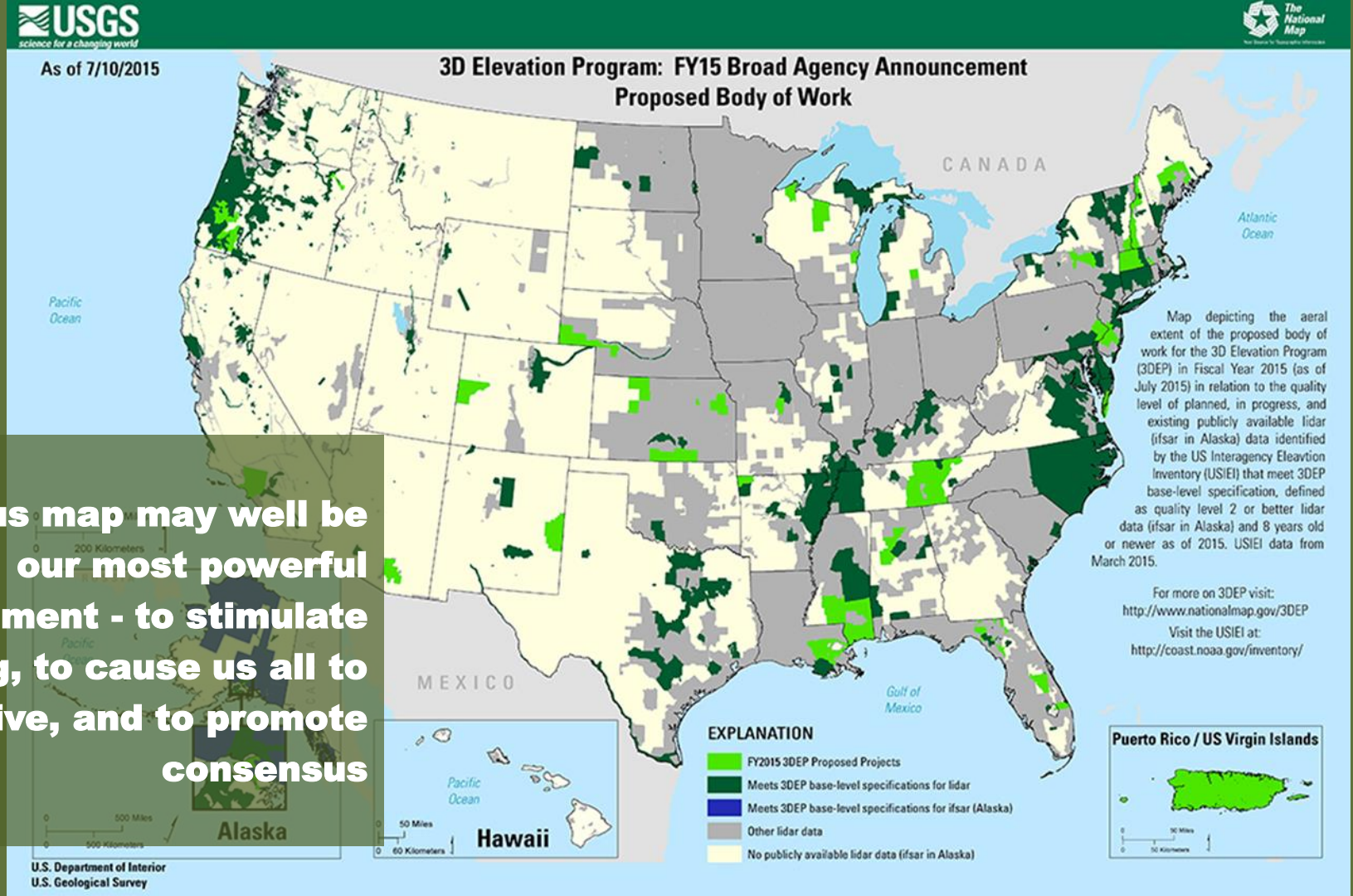
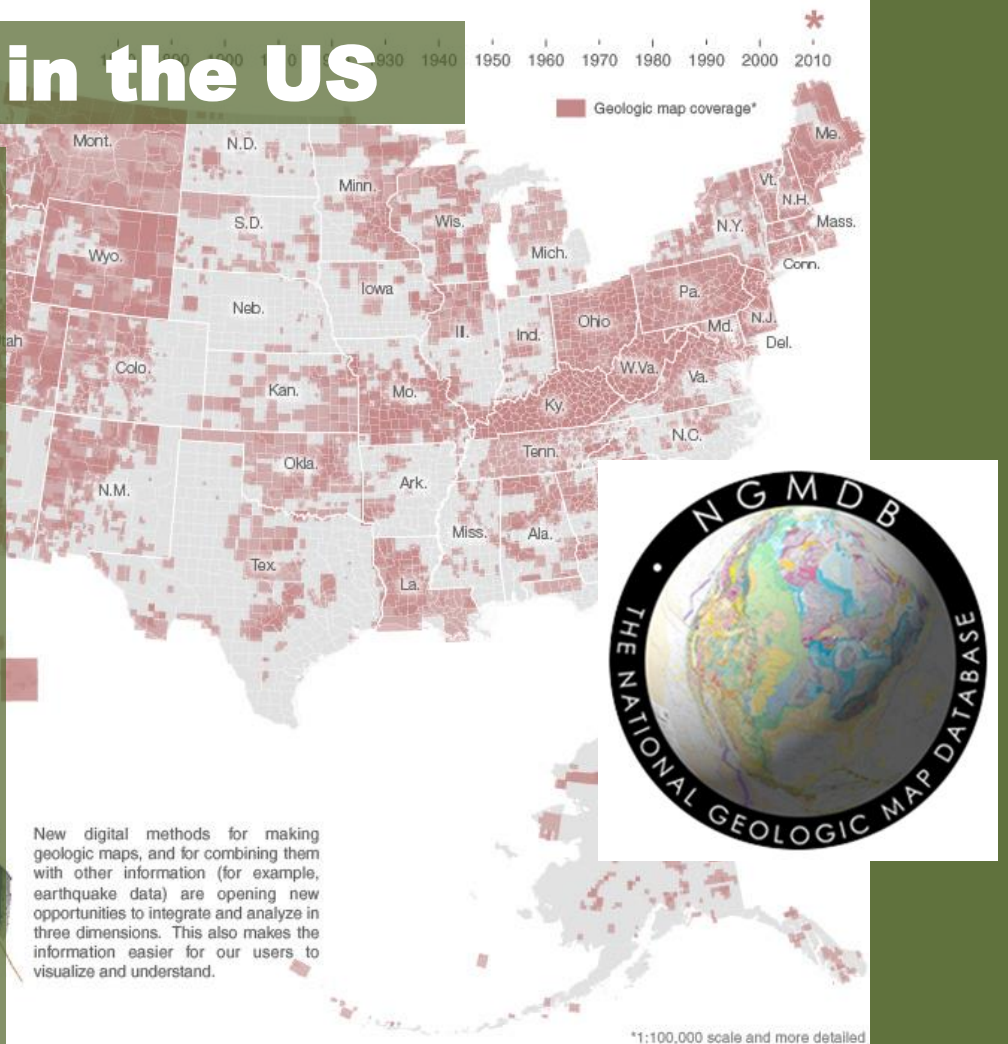



**A status map may well be our most powerful instrument - to stimulate funding, to cause us all to strive, and to promote consensus**

# Geological mapping in the US

**National Geologic Map Database status maps are superb and appreciated, although they are publication catalogs done for multiple map types, and they do not incorporate judgement regarding adequacy or currency; the map shown here only shows 1:100,000 and more detailed maps; many areas on this map might be covered by fully adequate maps such as 1:125,000, and some maps shown here plainly are out of date, and need to be redone**

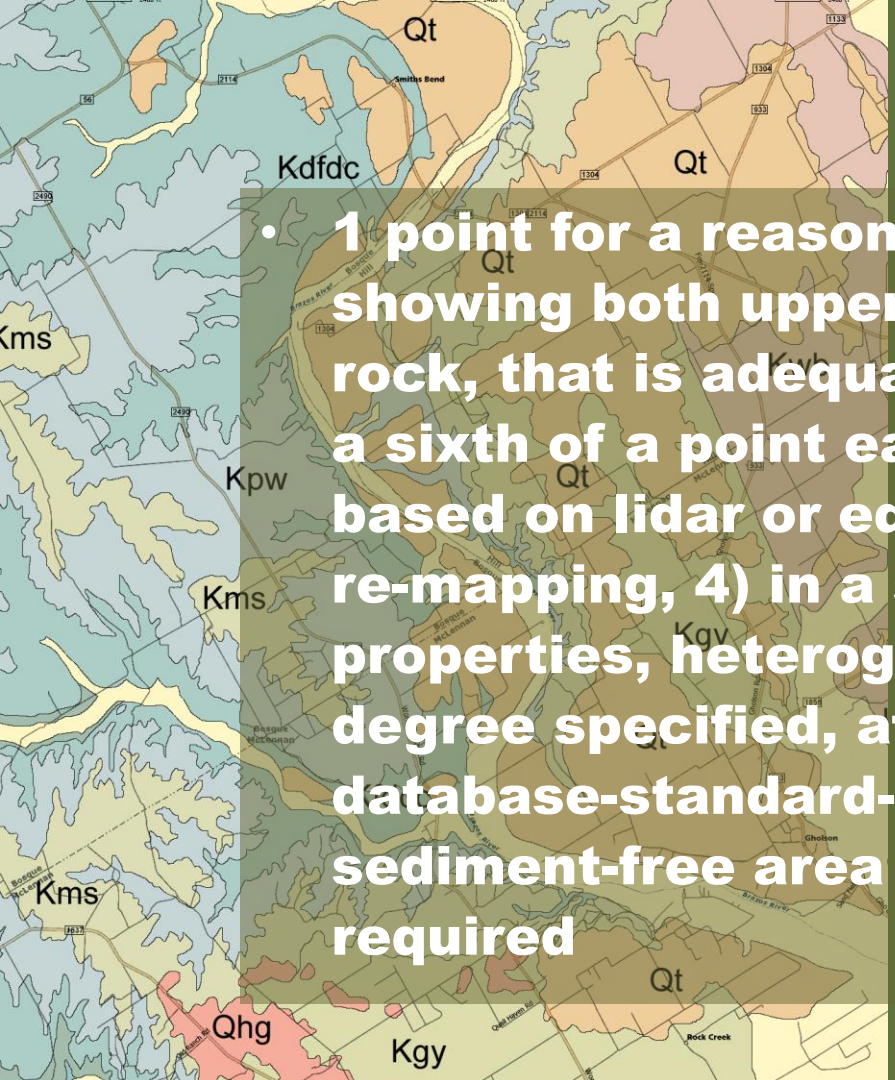


# Therefore, the following is proposed

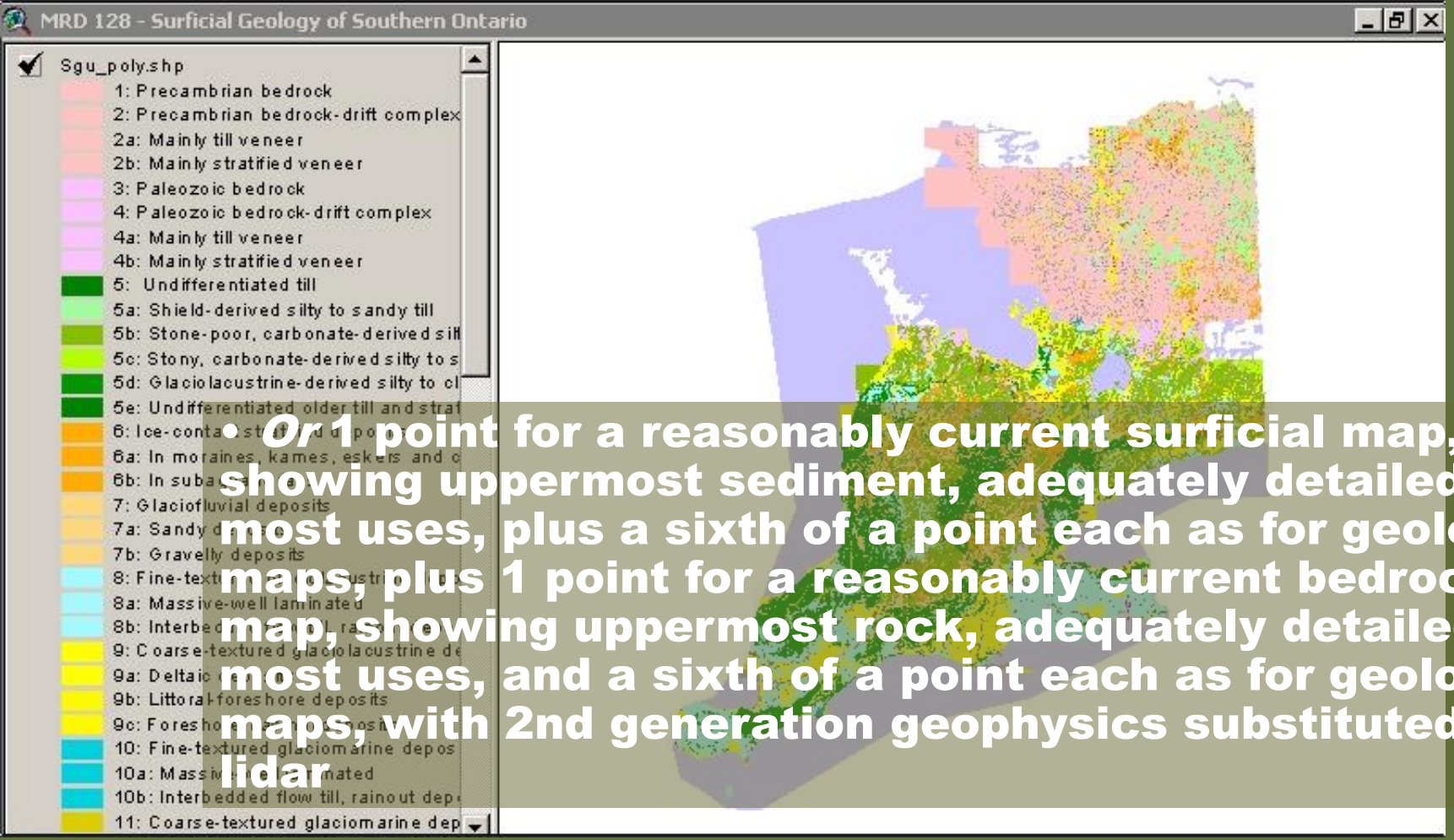
- ***Objective***: a 1-page map that presents an assessment, done by State Geologists, on a nationally consistent basis, of the status of geological mapping, broadly defined, onshore and offshore, that is more detailed than state geologic maps, and a vintage, resolution, or format not meant to be upgraded in the foreseeable future, for assessing status and not priority, utilizing polygons such as counties or quadrangles

- ***Definitions***: A layer is a 2D map polygon or deposit whose thickness can everywhere be mapped, and for which underlying geology can be drawn; sediments or rocks that are not a layer are basement; in some areas, there are Precambrian layers, so the basement map ≠ Precambrian map

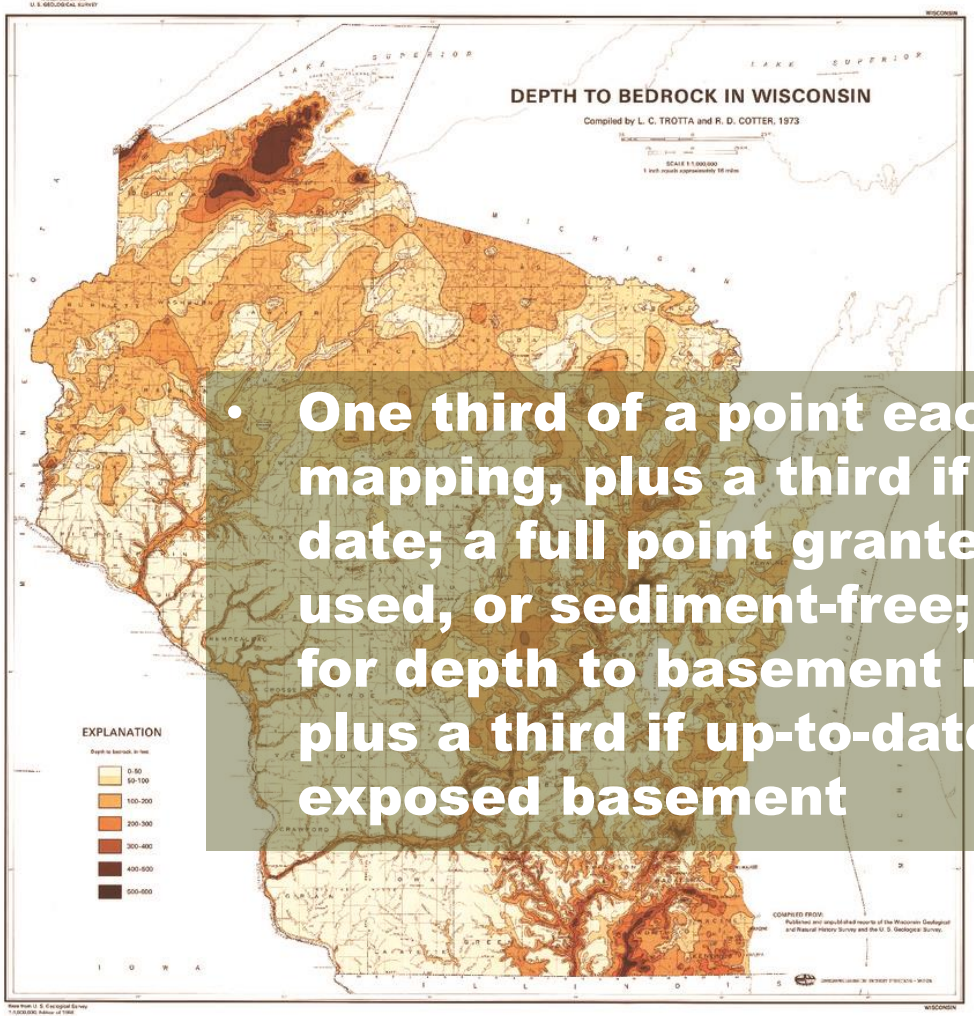
- ***Scoring***: The maximum score of 10 would be assigned to a county or quadrangle, or equivalent, for which, in the entire area, there are, with the score prorated by approximate extent of completion, the following:



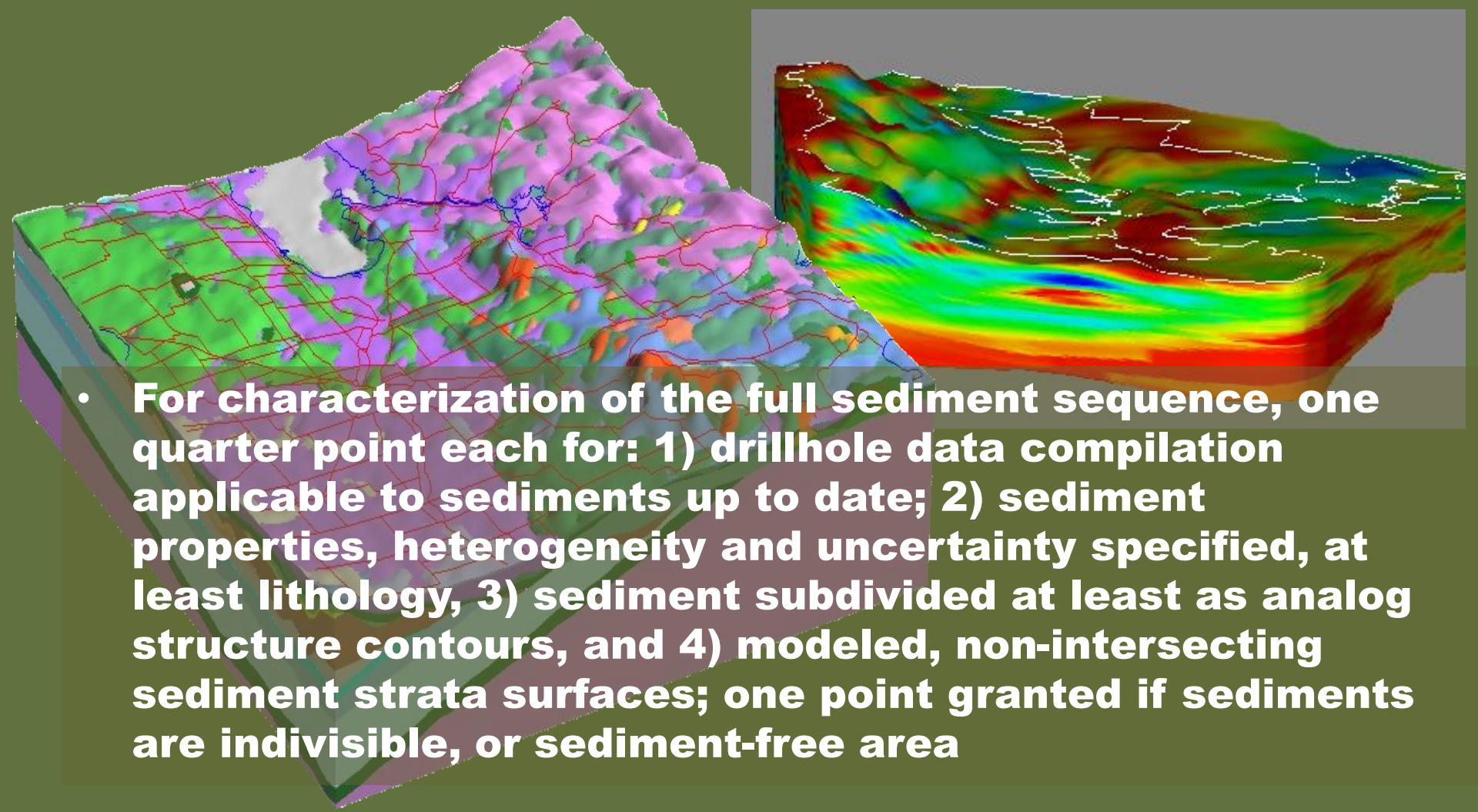

- 1 point for a reasonably current geologic map, showing both uppermost sediment and uppermost rock, that is adequately detailed for most uses, plus a sixth of a point each if that mapping is 1) digital, 2) based on lidar or equivalent, 3) not plainly in need of re-mapping, 4) in a statewide vector database, 5) properties, heterogeneity and uncertainty to some degree specified, at least lithology, and 6) GeMS database-standard-compliant; plus 2 points if in a sediment-free area for which a surficial map is not required



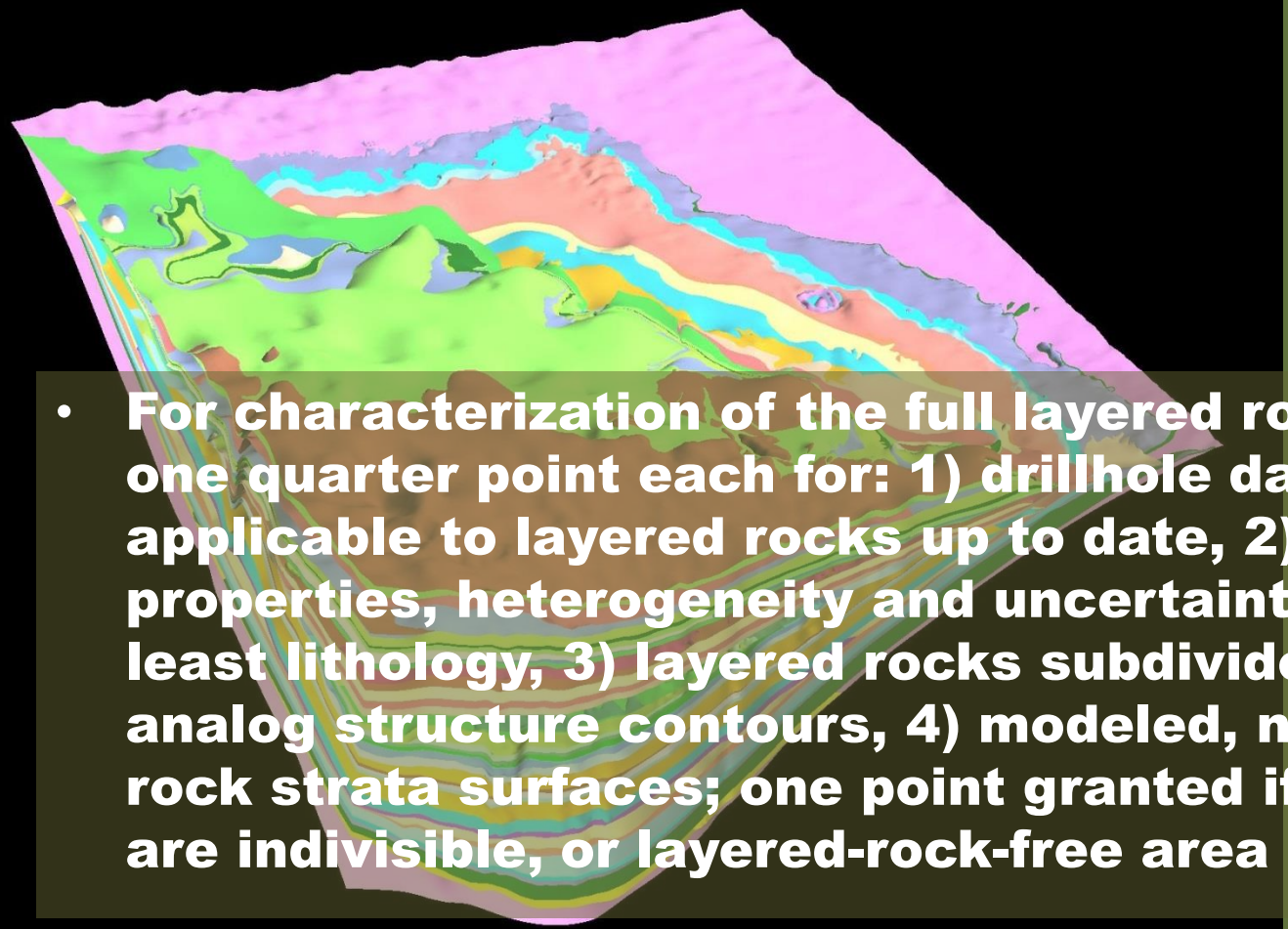

- *Or* 1 point for a reasonably current surficial map, showing uppermost sediment, adequately detailed for most uses, plus a sixth of a point each as for geologic maps, plus 1 point for a reasonably current bedrock map, showing uppermost rock, adequately detailed for most uses, and a sixth of a point each as for geologic maps, with 2nd generation geophysics substituted for lidar



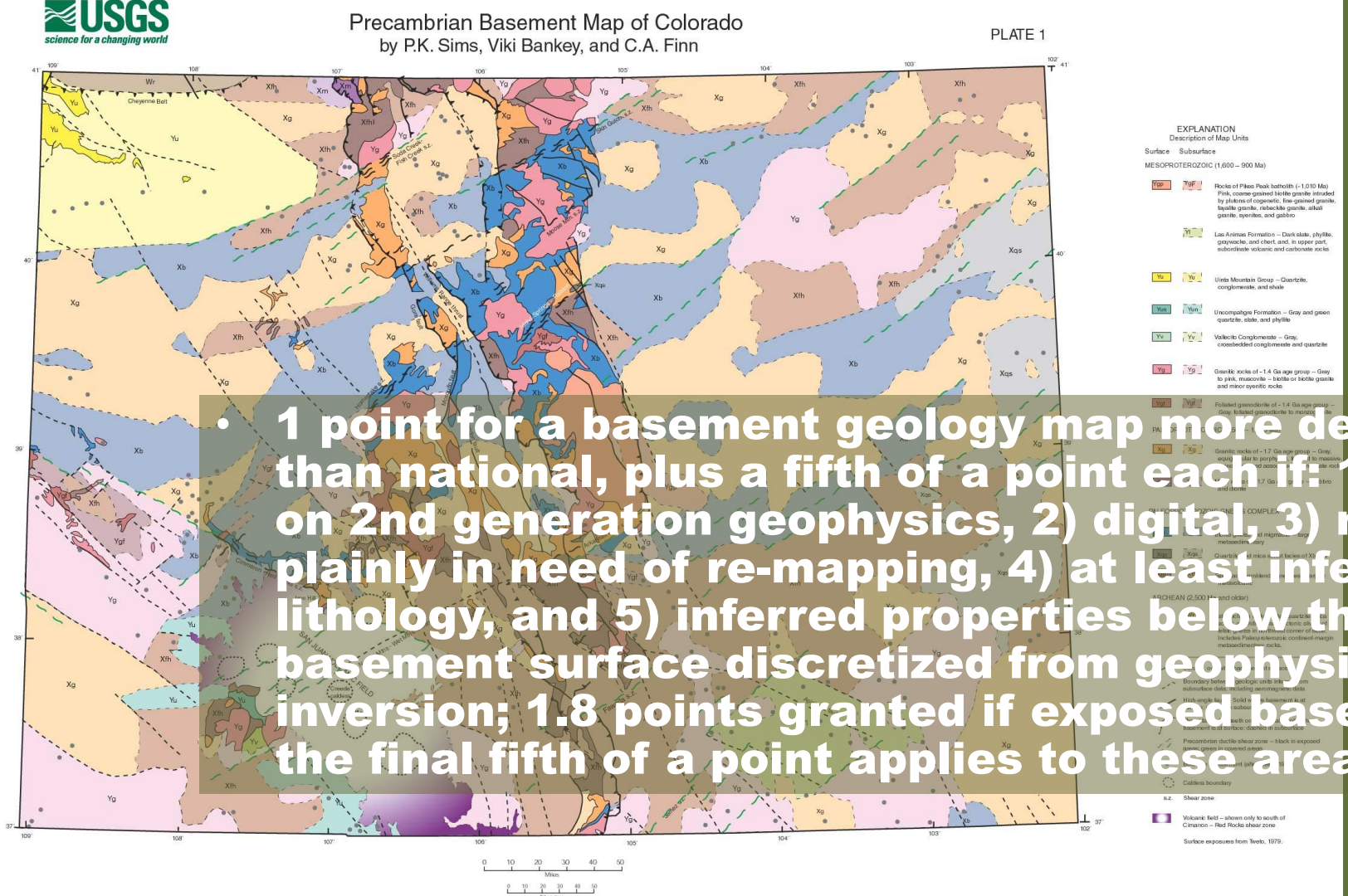

- One third of a point each for depth to bedrock mapping, plus a third if digital, plus a third if up-to-date; a full point granted if bedrock concept is not used, or sediment-free; plus one third of a point each for depth to basement mapping, plus a third if digital, plus a third if up-to-date; a full point granted if exposed basement



- For characterization of the full sediment sequence, one quarter point each for: 1) drillhole data compilation applicable to sediments up to date; 2) sediment properties, heterogeneity and uncertainty specified, at least lithology, 3) sediment subdivided at least as analog structure contours, and 4) modeled, non-intersecting sediment strata surfaces; one point granted if sediments are indivisible, or sediment-free area



- For characterization of the full layered rock sequence, one quarter point each for: 1) drillhole data compilation applicable to layered rocks up to date, 2) layered rock properties, heterogeneity and uncertainty specified, at least lithology, 3) layered rocks subdivided at least as analog structure contours, 4) modeled, non-intersecting rock strata surfaces; one point granted if layered rocks are indivisible, or layered-rock-free area



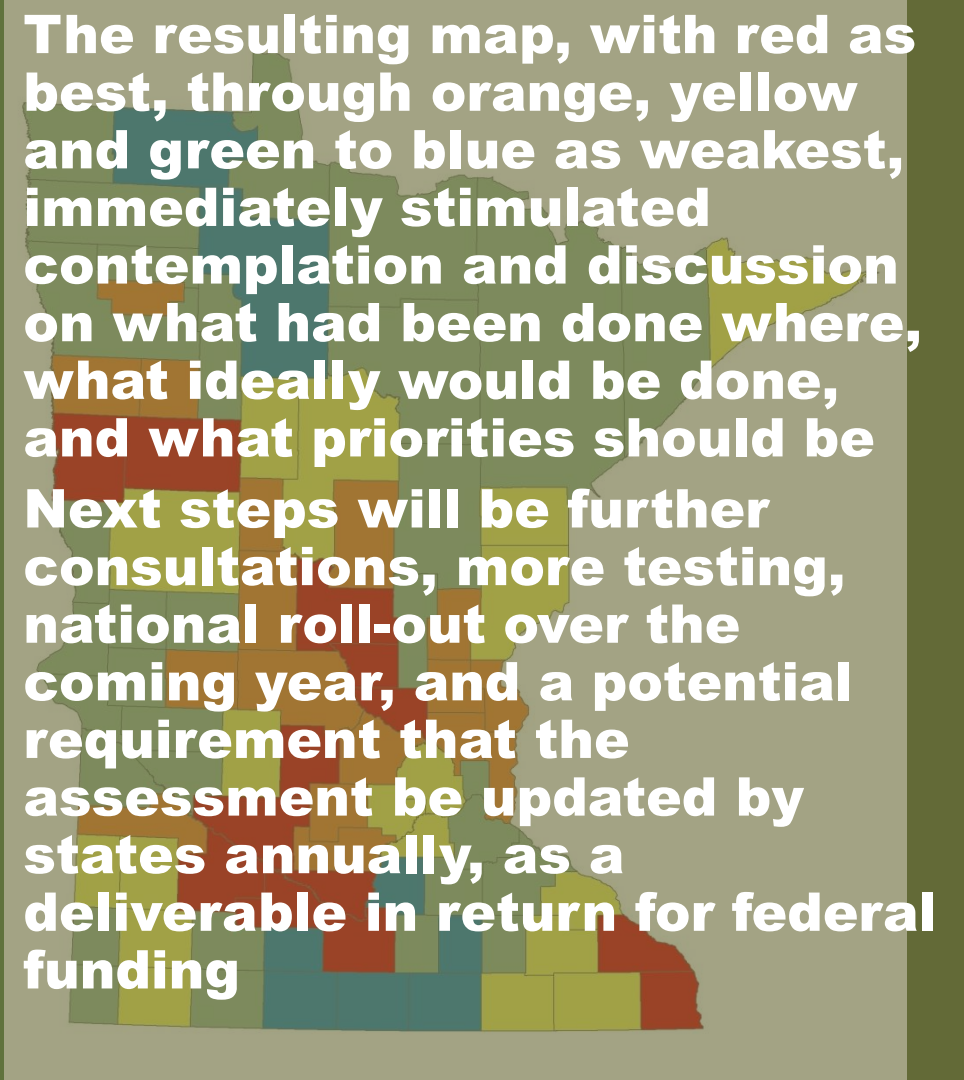

- 1 point for a basement geology map more detailed than national, plus a fifth of a point each if: 1) based on 2nd generation geophysics, 2) digital, 3) not plainly in need of re-mapping, 4) at least inferred lithology, and 5) inferred properties below the basement surface discretized from geophysical inversion; 1.8 points granted if exposed basement, as the final fifth of a point applies to these areas

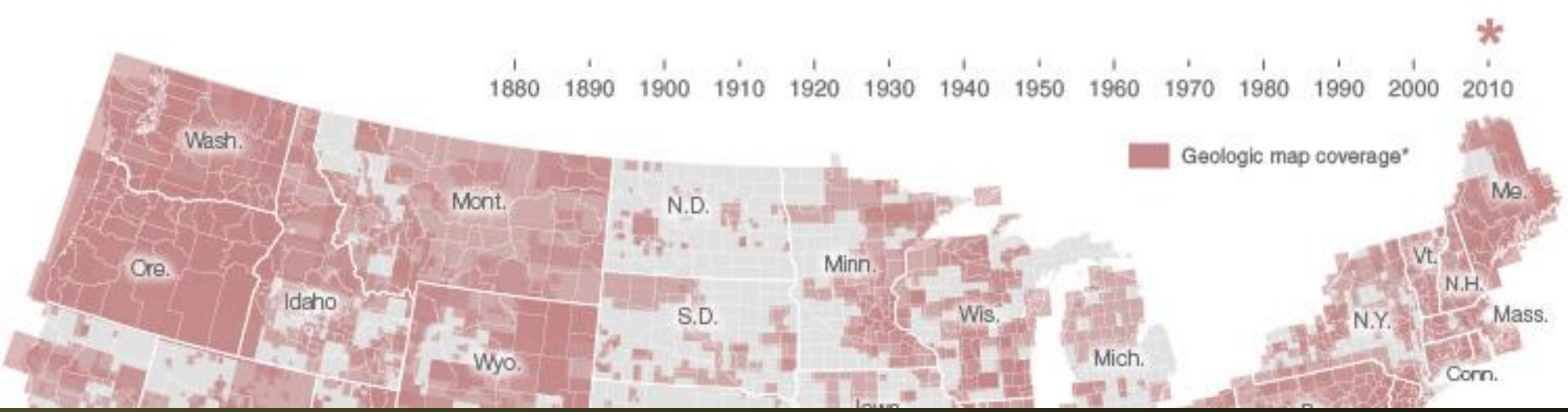
1. Total Score
2. % multiplier for proportion of the area covered
3. one a reasonably current geologic map that is adequately detailed for most uses
4. 1/6 digital
5. 1/6 based on lidar or equivalent
6. 1/6 not plainly in need of re-mapping
7. 1/6 in a statewide vector database
8. 1/6 properties, heterogeneity and uncertainty to some degree specified, at least lithology
9. 1/6 GeMS-compliant
10. two sediment-free area
11. Geologic Map Total
12. zero zero multiplier for surficial and bedrock if geologic mapping was scored
13. % multiplier for proportion of the area covered
14. one a reasonably current surficial map adequately detailed for most uses, or sediment-free area
15. 1/6 digital, or sediment-free area
16. 1/6 based on lidar or equivalent, or sediment-free area
17. 1/6 not plainly in need of re-mapping, or sediment-free area
18. 1/6 in a statewide vector database, or sediment-free area
19. 1/6 properties, heterogeneity and uncertainty to some degree specified, at least lithology
20. 1/6 GeMS-compliant, or sediment-free area
21. Surficial Map Total
22. % multiplier for proportion of the area covered
23. one a reasonably current bedrock map adequately detailed for most uses
24. 1/6 digital
25. 1/6 based on 2nd generation geophysics
26. 1/6 not plainly in need of re-mapping
27. 1/6 in a statewide vector database
28. 1/6 properties, heterogeneity and uncertainty to some degree specified, at least lithology
29. 1/6 GeMS-compliant
30. Bedrock Map Total
31. % multiplier for proportion of the area covered
32. 1/3 depth to bedrock mapped, or bedrock concept not used, or sediment-free
33. 1/3 digital depth to bedrock, or bedrock concept not used, or sediment-free
34. 1/3 up-to-date depth to bedrock, or bedrock concept not used, or sediment-free
35. Depth to Bedrock Total
36. % multiplier for proportion of the area covered
37. 1/3 depth to basement mapped, or exposed basement
38. 1/3 digital depth to basement map, or exposed basement
39. 1/3 up-to-date depth to basement map, or exposed basement
40. Depth to Basement Total
41. % multiplier for proportion of the area covered
42. 1/4 drillhole data compilation applicable to sediments up to date
43. 1/4 [illegible]
44. 1/4 [illegible]
45. 1/4 modeled, non-intersecting sedimentary strata, indivisible, or sediment-free area
46. Sediment Layers Total
47. % multiplier for proportion of the area covered
48. 1/4 drillhole data compilation applicable to layered rocks up to date
49. 1/4 layered rock properties, heterogeneity and uncertainty specified, at least lithology
50. 1/4 [illegible]
51. 1/4 [illegible]
52. Layered Rocks Total
53. % multiplier for proportion of the area covered
54. one a reasonably current basement map adequately detailed for most uses
55. 1/5 based on 2nd generation geophysics, or exposed basement
56. 1/5 digital, or exposed basement
57. 1/5 [illegible]
58. 1/5 [illegible]
59. 1/5 inferred properties below the basement surface discretized from geophysical inversion
60. Basement Total

- the procedure that you see here was applied to Minnesota as a test; this took an effort of one day last month, as we have the materials largely in hand

The resulting map, with red as best, through orange, yellow and green to blue as weakest, immediately stimulated contemplation and discussion on what had been done where, what ideally would be done, and what priorities should be

Next steps will be further consultations, more testing, national roll-out over the coming year, and a potential requirement that the assessment be updated by states annually, as a deliverable in return for federal funding



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